





SCIENCE FAIR SERIES:  
HYPOTHESIS & DESIGN  
STATEMENTS

Examples




# Types of Projects

- Inquiry Based Experiment.
  - Inquiry based is the familiar science experiment we are all familiar with the incorporates the scientific method.
- The Engineering/ Design Project.
  - An engineering design project is an innovation (invention) or design improvement.
  - ISEF Definition: Projects that directly apply scientific principles to manufacturing and practical uses--civil, mechanical, aeronautical, chemical, electrical, photographic, sound, automotive, marine, heating and refrigerating, transportation, environmental engineering, etc

# Types of Projects

Computer Programming		Math Projects
<b>Engineering Process</b>	<b>Scientific Method</b>	<b>Mathematical Reasoning/</b>
Define a need	State a question	Define what is known
Do background research	Do background research	Do background research and define all terminology
Establish design criteria	Formulate your hypothesis, identify variables	Make a conjecture/ assumption based on what you know
Prepare preliminary designs	Design experiment, establish procedure	Perform calculations
Build and test prototype	Test hypothesis by doing experiment	Look for counter examples
Test and redesign as necessary	Analyze your results and draw conclusions	Recalculate and write up steps to the conclusion
Present results.		
<i>Scientific Method and Engineering Process comparison used with permission by Science Buddies.</i>		

The image features three glowing yellow lightbulbs, each resting on a different colored rectangular block. The leftmost block is light blue, the middle one is pink, and the rightmost one is yellow. The lightbulbs are illuminated, casting a soft glow. The background is a light, neutral color. A semi-transparent white rectangular area is overlaid in the center, containing the text.

# SCIENTIFIC INQUIRY

Hypothesis Examples

## **Format of a hypothesis**

- If [cause / independent variable]
- Then [effect/ dependent variable]
- Because [principle of science tested]

# Example 1

- If hydrogen peroxide is applied to hydroponically grown soybeans
- Then germination and plant growth rate will be greater in the hydroponic system.
- Because: it strengthens the plants and kills pathogens and bacteria.

## Example 2

- If I play no music
- Then people will type faster and more accurately
- Because: There is a neuropsychological link between music and the brain. I am testing to see if that link affects productivity, and if so, how.

## Example 3

- If natural buffers are placed in clay soil,
- Then plants will grow the best during prolonged acid rain conditions
- Because: buffers help to prevent pH changes in the soil that would affect plant nutrient absorption.



## Example 4

- If : a Pratt truss is used on a model bridge
- Then: it will have a better efficiency (weight held/mass) when tested with a single centralized weight in the middle
- Because: the truss will distribute the weight better throughout the whole bridge.

## Example 5

- If : a nail is set up 3 inches away from a magnet
- Then: adding weights to the nail will stop the nail from going to the magnet.
- Because: the forces on each side of the nail will be balanced.

## Example 6

- If : bananas are allowed to ripen over time,
- Then: the sugar content will increase over time,
- Because: as fruit ripens the enzyme amylase, which is present due to ethylene production, accelerates hydrolysis of starch into sugar which can be measured by using a refractometer.

## Example 7

- If : fidget toys enhance concentration and observational skills,
- Then: utilizing a fidget toy while watching a video will increase a person's ability to recall details from the video that would go unnoticed without the use of a fidget toy
- Because: higher levels of concentration allow more information to be processed by the brain and later recalled.

## Example 8

- If : colored paper is added to the learning environment
- Then: one's ability to remember will increase noticeably in any learning scenario
- Because: synapses will be sent to the sensory register store based off of the environmental stimuli, in this case color. This information is stored here until it has received enough attention to be moved to a different parts of the brain, the short or long term memory store.

## Example 9

- If : premade helmets (baseball, hardhat, bike, skateboard) provide protection and are made with different materials, paddings, and are shaped differently, which types of helmets provide safe protection of pumpkins when dropped from different heights?
- Then: the helmet provides some protection depending on the height of the drop and the materials, paddings and shapes of the helmets.
- Because: The pumpkin inside the helmet was or wasn't protected due to the absorption of the force of impact depending on the material of the helmet and the height the helmet was dropped.

## Example 10

- If : students are given less homework
- Then: the grades of the student would significantly increase compared to their prior grade
- Because: the more work given over a certain period of time would decrease their sleep since they would have to stay up and complete their work task, and as many studies have proven the less sleep the grades decrease.

# Example 11

- If : the humidity and temperature are above 30% and between 60 – 90 degrees;
- Then: bread mold will grow (Rhizopus Stolonifer, Aspergillus Niger, and Penicillium)
- Because: those are the ideal conditions for bread mold growth.



## Example 12

- If : the electromagnet and a neodymium magnet poles repel each other at one side and the other side poles pull against each other...
- Then: the two magnetic forces will be pulling/ pushing in the same direction to become on big force that will propel the battery "train car"...
- Because: the battery is sandwiched between two neodymium magnets it'll become electromagnetic between the two magnets because an electric current is flowing through the copper coil.

## Example 14

- If : There are two quarters and one nickel placed next to each other, and the coins are randomly heads or tails
- Then: The human being tested will chose the quarter that is heads up
- Because: there is a concept in society that heads is better than tails and the concept that the quarter is worth more than the nickel

# Example 15

- If : the milk curdles when we add any of the citrus's, including Lemon, Lime, Orange and others, then the Ph of the acid from the citrus is lower than that of the milk
- Then: The lower Ph of the solution we add to the milk will cause it separate, and thus curdle. The larger the difference in the Ph of the solution and that of the Milk, the faster it will curdle.
- Because: to the difference in their Ph levels, the milk curdles. this is caused by the difference in Ph levels, the molecules of the milk are either attracted to or repelled by the acidity of the added solution.

## Example 16

- If : the length or thickness of an arch is increased, while keeping all other variables constant (span, material and temperature),
- Then: the arch strength will increase, but not in a perfect ratio.
- Because: The downward force of any weight is carried along an arch to its supports. The arch experiences compression along the bottom and tension on the top.

## Example 17

- If : the viscosity of a liquid that which sand is mixed with is high
- Then: the settling time of the sand will be longer
- Because: Stroke's law

## Example 18

- If : Towers built with triangle bracing
- Then: will hold the most vertical load
- Because: it will increase the compression strength of the columns.

The image features three glowing yellow lightbulbs, each resting on a different colored rectangular block. The largest lightbulb is on a light blue block on the left. The middle lightbulb is on a pink block in the center. The smallest lightbulb is on a yellow block on the right. The background is a soft, light gray gradient. A semi-transparent white rectangular area is overlaid in the center, containing the text.

# ENGINEERING DESIGN

Engineering Design

## Format of a Design Statement

The water filter (product) shall provide victims of flood (user) with a way to clean and filter water for drinking (functionality requirements).



# Example 1

- **Product:** A mouth guard that can record the impact of the hit you sustain, as well as if you have a concussion.
- **User:** Athletes
- **Functionality:** Must be able to display severity of hit. Mouth guard, something to record the impact.

## Example 2

- **Product:** A system to convert kinetic energy from drain water and convert it to electric energy as a new sustainable energy source.
- **User:** As a source for green energy everyone can benefit.
- **Functionality:** It'll have to create electricity.
- **Materials:** an electric generator, a lightbulb, PVC pipe, wire, a water source, a mechanism for determining water flow

## Example 3

- Product: alternative to a plastic dog cone
- User: dogs with the need for a cone- could be sold to veterinarians
- Functionality: allow dogs more mobility, keep them safer from biting their surgical incisions, and decrease incidents of household mobility accidents
- Materials: plastic, rubber, cardboard, foam, and fabric

# Example 4

- Product: automatic cat feeder
- User: two cats (Fluffy and Uggz)
- Functionality: cat food daily while owners are on vacation
- Materials: 1.5" PVC pipe, 1.5" PVC Wye, 1.5" x 3.0" PVC adapter, 1.5" PVC threaded end, 1.5" PVC threaded cap, PVC pipe cleaner, PVC pipe glue, aluminum box, wooden base, plastic pretzel jar, 15rpm 120V AC shaded-pole motor, programmable timer, power cord, wire blade terminals, pop rivets, 0.75" aluminum tube, plastic for bushing, large steel corkscrew for tying dog in yard, 3/8" rubber gas hose, hose clamp, 3/8" plastic tube from ball-point pen, variety of screws, 1/4" nuts, 1" x 3" x 0.13" rectangular aluminum tube, 0.13" aluminum plate, 0.25" aluminum plate, shrink tube insulation, electrical wire clamp, electrical tape, cat food bowls.

## Example 5

- **Product:** Cheap effective water filter made with materials strictly found around the house
- **User:** clean water in emergencies and cheap water filtration for third world countries
- **Functionality:** The product must be able to intake water and filter it and dispense clean water
- **Materials:** Activated Charcoal, Water Bottle, Collection container, Sand, Gravel, coffee filter, rubber bands, sapwood (from tree)

## Example 6

- Product: Supplementary product for the medical walking boot
- User: those with ankle, foot, and/or lower leg injuries who have been prescribed a medical boot
- Functionality: support for the other (non-injured) leg to reduce the negative effects of the medical walking boot
- Materials: materials such as rubber and other shock-absorbent building components and a camera to photograph and document our progress.

# Example 7

- **Product:** The end product will be a device to hold a dogs toy steady as they chew or play with it
- **User:** Anyone who owns a dog that constantly comes to their owner with their toy while the owner is busy
- **Functionality:** It must withstand tugging, pawing, and biting to hold the toy steady so that the dog stays occupied for a extended period of time
- **Materials:** Bars (plastic and metal), adjustable (tightening/morphing) plastic end

# Example 8

- **Product:** The product will be an environmentally friendly, insulated sitting mat. With an intended purpose of elevating the user off of the ground.
- **User:** The product should provide the homeless with a warm and water repellent surface to sit on, as opposed to the ground. It can also be used by the victims of natural disasters, who have been rendered homeless. This product can also be used for outdoor events, such as concerts.
- **Functionality:** The product must be water repellent, and environmentally friendly. It must also have the ability to retain and maintain heat, to keep the user warm.
- **Materials:** I will be researching the most effective insulated material to be placed inside the mat. The outer shell of the sitting mat will be constructed from plastic (grocery) bags, which have been fused together, to create a water repellent fabric. I will be conducting a series of tests, to determine its durability, heat retention and repellency.



# Example 9

- **Product:** The safety sleeper when used correctly will decrease the percentage of deaths in babies from SIDS (Sudden Infant Death Syndrome).
- **User:** The user of the Safety Sleeper, would include babies between the ages of zero to twelve months. Also, this device will be involving parents of infants.
- **Functionality:** This product will provide parents an alarm when their infant child stops breathing after a short, certain amount of time. Thus, decreasing the amount of baby deaths.
- **Materials:** The Safety Sleeper will be made up of a motion sensor, an alarm, a baby sleeper, and cotton to enclose the device in material.

## Visit **NEOHSTEM Alliance Website**

- For more project information
- <http://neohstem.org/>

## Contact the **Science & Technology Division at Akron-Summit County Public Library**

- 330-643-9075
- [stdiv@akronlibrary.org](mailto:stdiv@akronlibrary.org)